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Exchange Rate Uncertainty and Optimal Participation in International Trade

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Abstract

Instead of just focusing on the effect of *exchange rate levels* (undervalued or overvalued exchange rates) on trade, this paper provides an analysis of the effects of *exchange rate volatility levels* on international trade. Intuitively, an increase in exchange rate volatility leads to uncertainty for agents participating in international trade, and such uncertainty might have a negative impact on international trade flows and participation, thereby reducing the advantages of world-wide specialization. This is especially crucial for countries where exchange rate derivatives markets are not yet well developed and the costs of hedging exchange rate risk are very high. The model here considers optimal decisions about participation in international trade under uncertainty about the exchange rate. The main conclusion is that a high level of exchange rate volatility can deter entrepreneurs from becoming exporters, even though exporting can be highly profitable. For those already participating in international trade, it is opposite: they may, optimally, choose not to leave the market even though staying in this market is highly unprofitable in the short run.

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1. Introduction

Recent developments of the international monetary system have reinvigorated the policy debate over the pros and cons of different current exchange rate regimes. One topical issue in this recent debate is the effects of undervalued exchange rates on trade, a policy that has been followed by export-led countries to achieve economic growth. These economies are expected to move toward more flexible exchange rates, thus making it easier for each of these countries to insulate themselves from foreign shocks and benefit from a more independent monetary policy. Instead of just focusing on the effect of *exchange rate levels* (undervalued or overvalued exchange rates) on trade, this note provides an analysis of the effects of *exchange rate volatility levels* on international trade. Intuitively, an increase in exchange rate volatility leads to uncertainty for agents participating in international trade, and such uncertainty might have a negative impact on trade flows, thereby reducing the advantages of world-wide specialization.

I assume that firms are risk-averse, which implies that they care about not only their expected profits but also the risk premium associated with their returns to exporting. The exchange rate variance will then be an important component in the objective function of the exporters. Optimal decisions made by participants regarding whether to participate or not in international trade depend on the (upper and lower) margins of variance of the exchange rate. The latter represents uncertainty which I consider to be particularly crucial for new young firms that evaluate whether or not to participate in trade markets. The analysis of such issues represents a notable contribution to the literature. The costs of entry for firms entering the export market are assumed different from the costs of exit for those already in the market.

Krugman (1989) and Dixit (1989a) are those in the literature closest to the approach proposed here. Their approaches are however limited to studying only how the distance between the highest and the lowest *levels* of the exchange rate (e.g. the *width of the exchange rate band*) might affect firms' participation in international trade. It is then important again to stress that in Krugman's and Dixit's models, only the highest and lowest value of the exchange rate *levels* matters. Note that in their model, in contrast to what I present here, risk aversion does not play an important role and as a consequence neither the exchange rate volatility. Both authors assume that the exchange rate follows a Brownian motion process. They study cases where the possibility of exiting or entering the international trade markets has an option value for the firms. These firms may or may not exercise their options to enter into or to exit from international trade markets.

The model proposed here then represents a relevant alternative which provides new insight into the relationship between international trade and exchange rate volatility through the exchange rate volatility channel. Considering that the exporting firms' decisions to enter and exit the export market depend on both the level and variance of the exchange rate is important, unless the fluctuation area for the exchange rate becomes common knowledge to the public, as in the regime of target zones for the exchange rate. My approach becomes essential for cases in which it is difficult to predict the equilibrium level of the exchange rate (including cases in which the exchange rate follows a random walk). After all, it is well known that it is less troublesome to predict the variance than the level of the exchange rate, and entrepreneurs would rationally take advantage of such information.

On the empirical front, there is yet no strong consensus on the relationship between exchange rate volatility and trade.[1] Several factors can explain this tenuous relationship: (i) the availability of hedging techniques could make it possible for traders to avoid most of the potential exchange risk at little cost; (ii) there could be substantial *pricing to market* which implies that firms selling goods in other countries do not have the prices charged in the importing country changed as much as one might otherwise expect; and iii) firms planning to enter the export sector incur *sunk costs*, that is, substantial investments in resources to adapt their products to the foreign markets, in market development and distribution networks, and in creating production capability geared at foreigners' preferences.

2. The Model

Consider a risk-averse firm that is able to sell a good in the foreign market. Whenever a firm decides to participate in international trade, it needs to incur a fixed cost F^I in domestic currency. F^I is sunk after being incurred. A firm that reenters in the export market will need to incur another such a cost. While a firm that continues being an exporter faces another fixed cost, F^O. F^I is assumed to be larger than F^O, which means that the entry cost can be recovered on exit. Firms, whether they decide to produce to the domestic market or the export market, incur in variable costs equal to V which do not need to be related to the exchange rate. The decision to enter or exit the trade market is an investment decision that renders returns. We assume that these returns are highly correlated with the level of the exchange rates. Thus, returns become

[1] Abrams (1980), Thursby and Thursby (1987) find large negative effects of nominal variability on trade; while Eichengreen and Irwin (1996) and Frankel (1997) report a negative but small effect. On the other hand, Rose (2000), Engel and Rose (2000), Frankel and Rose (2002), amd Alesina, Barro and Tenreyro (2002) find that the effects of currency unions and unilateral dollarization on trade are positive and large. Tenreyro (2004) finds that there is no effect of exchange rate variability on trade.

uncertain because of the exchange rate but not because of the prices of exported goods since firms practice the pricing to market policy.

The possible returns from entering the export market take values r^I_1, r^I_2, …, r^I_n with corresponding probabilities. These series of possible returns, are represented by $\tilde{r}^I(\theta)$, have expected value equals to θ^I ($E[\tilde{r}^I(\theta)]=\theta^I$), and variance $\sigma^{2,I}$, and they are the same for all firms entering (or reentering) the export market. The potential returns from continuing in the market are r^O_1, r^O_2, …, r^O_n also with corresponding probabilities. We shall represent these returns by $\tilde{r}^O(\theta)$. Similarly, these returns have mean θ^O and variance, $\sigma^{2,O}$. Also here θ^O and σ^2 are equal for all firms considering continuing being exporters. The differences in the distributions may be due to entrepreneurs that are already in the market having different opportunities to manage exchange rate risk and information from those already in the market. The return for only selling in the domestic market is however a certain price one and equals **P.**

Each entrepreneur has an initial income equal to $W_0 > 1$, and a CARA[2] utility function.

The entrepreneur that evaluates *entering* (or reentering) the trade markets has the following expected utility out of net returns minus the sunk costs ($W_0 - F^I - V + \tilde{r}^I(\theta)$): [3]

$$Eu(W_0 - F^I - V + \tilde{r}^I(\theta)) = u\left(W_0 - F^I - V + \theta^I - \frac{1}{2}\rho\sigma^{2,I}\right) \qquad (1a)$$

($1/2\rho\sigma^{2,I}$) is the risk premium he would be willing to give up rather than face the exchange rate risk. With a CARA utility function, this risk premium depends on the variance of the uncertain return.

[2] CARA stands for Constant Absolute Risk Aversion.
[3] The derivation of (1a) is not reported due to space constraint.

An entrepreneur that *remains* in the export market has the following expected utility out of returns minus the costs of staying the market ($W_0 - F^O$ -V+ $\tilde{r}^I(\theta)$):

$$Eu(W_0 - F^O - V + \tilde{r}^O(\theta)) = u\left(W_0 - F - V + \theta^O - \frac{1}{2}\rho\sigma^{2,O}\right) \quad (1b)$$

($1/2\rho\sigma^{2,O}$) is also a risk premium for this type of entrepreneur.

An entrepreneur who only participates in the domestic market will obtain utility equal to $u(W_0 - V + P)$.

An entrepreneur will choose to continue participating in or entering the export market if, by doing so, he derives a higher utility than the one selling only in the domestic market. We translate this into the following conditions:

An entrepreneur will enter the market if:

$$u\left(W_0 - F^I - V + \theta^I - \frac{1}{2}\rho\sigma^{2,I}\right) > u(W_0 - V + P); \quad (2a)$$

But (2a) is satisfied if:

$$\theta^I > P + F^I + 1/2\rho\sigma^{2,I} = M^I \quad (3a)$$

Similarly, an entrepreneur may still want to continue being an exporter if:

$$u\left(W_0 - F^O - V + \theta^O - \frac{1}{2}\rho\sigma^{2,O}\right) > u(W_0 - V + P); \quad (2b)$$

But (2b) is satisfied if:

$$\theta^O > P + F^O + 1/2\rho\sigma^{2,O} = M^O \quad (3b)$$

M^I and M^O are the Marshallian trigger returns for entering and remaining in the export market, respectively (similar to Dixit (1989b)). At a return between M^I and

M^O, a domestic firm does not take part in international trade, and a firm which is already active in international trade does not exit.

Now, as the sunk cost, F^I, and the fixed cost of remaining being exporters, F^O, both tend to zero, $\theta^I - 1/2\rho\sigma^{2,I}$ and $\theta^O - 1/2\rho\sigma^{2,O}$ tend to *P*, the return to participating only in the domestic market. The inequalities (3a) and (3b) will remain even when F^I or F^O becomes zero. That is, if the sunk costs for the entrepreneur evaluating whether to participate in international trade, F^I, becomes zero, the entering trigger $\theta^I - 1/2\rho\sigma^{2,I}$ has to be still above P. In addition, for a firm knowing that by not participating in international trade now, it can avoid F^O for being an exporter whenever future development of the exchange rate level and volatility turn unfavorable. It is also important to notice that the *greater the range of uncertainty in the exchange rate (greater variances $\sigma^{2,I}$ and $\sigma^{2,O}$) widens the range of inaction* (e.g. the range between M^I and M^O).

Therefore, the exchange rate volatility is the major variable that exporters will take into account to make optimal decisions about their participation in international markets, and possibly to adjust to relative changes in international relative prices to be able to remain exporting.

3. Conclusions

I have presented a model of optimal decisions about participation in international trade under uncertainty about the exchange rate. The main conclusion from the model is that the greater the volatility levels of the exchange rate, the higher are the trigger returns at which it becomes optimal to enter or respectively exit the export market.

A consequence of this result is that a high level of exchange rate volatility can deter certain entrepreneurs from becoming exporters, even though exporting can be

highly profitable. For those already participating in international trade, it is opposite: they may, optimally, choose not to leave the market even though staying in this market is highly unprofitable in the short run.

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